MATH 113 – Fall 2004 – Prof SACHS

HOMEWORK 2 COMMENTS / SOLUTIONS

1.1

#5 (a) Using $Q_1 \approx (10,220)$, $Q_2 \approx (14,380)$, $Q_3 \approx (16,470)$, $Q_4 \approx (18,550)$

slopes are: $PQ_1 \approx \frac{430}{10} = 43$, $PQ_2 \approx \frac{270}{6} = 45$, $PQ_3 \approx \frac{180}{4} = 45$, $PQ_4 \approx \frac{100}{2} = 50$

NOT EXACT → (b) ESTIMATE 50 or slightly higher.

#10 (a) limit is 0 ["fill in value"] (b) limit is −1 (c) Doesn't exist – can't match right/left

#12 (a) False – limit is 1 (b) False – wrong value (c) true – mismatch L/R

(d) True – values are on graph (e) true – limit exists, even at 2

#32 $|(2x-2)-(-6)| < 0.02$ – Simplify inside abs. value:

$2x-2+6 = 2x+4 = 2(x+2)$ so $|(2x-2)-(-6)| = |2(x+2)| = 2|x+2|$

We find $2|x+2| < 0.02$ when $|x+2| < 0.01$ [divide by 2]

Thus $-2.01 < x < -2+0.01 = -1.99$ and $\delta = .01$ works.

#34 $|\sqrt{19-x} - 3| < 1 \iff -1 < \sqrt{19-x} - 3 < 1$ which

is equivalent to: $2 < \sqrt{19-x} < 4$

Therefore $4 < 19-x < 16$ – solve for x in parts

$4 < 19-x \iff x < 19-4 = 15$ and $19-x < 16 \iff 3 < x$

So $3 < x < 15$ – with center 10 we can go 7 left, 5 right

so $\delta = 5$ or smaller works.

1.2

#12 (a) $\lim_{r \to -2} (r^3 - 2r^2 + 4r + 8) = -8 - 8 - 8 + 8 = -16$

(b) $\lim_{x \to 2} \frac{x+3}{x+6} = \frac{2+3}{2+6} = 5/8$

(c) $\lim_{y\to -3} (5-y)^{4/3} = 8^{4/3} = 2^4 = 16$

(d) $\lim_{\theta\to 5} \frac{\theta-5}{\theta^2-25}$: $\frac{0}{0}$ unless we divide / factor

$= \lim_{\theta\to 5} \frac{\theta-5}{(\theta-5)(\theta+5)} = \lim_{\theta\to 5} \frac{1}{\theta+5} = \frac{1}{5+5} = \frac{1}{10}$

#22 (a) $\lim_{x\to 2^+} f(x) = 2$ from graph; $\lim_{x\to 2^-} f(x) = 1$ also

(b) It doesn't exist: L/R mismatch

(c) $\lim_{x\to 4^+} f(x) = 3$; $\lim_{x\to 4^-} f(x) = 3$ – limit exists, equals 3.

(d) $\longrightarrow$

#24 (a) $\lim_{x\to 0^+} g(x) = 0$ by sandwich: $-\sqrt{x} \le g(x) \le \sqrt{x}$

(b) $\lim_{x\to 0^-} g(x)$ doesn't exist since domain is $x > 0$.

(c) No – no limit from left implies no limit.

#36 (a) $\lim_{x\to 2} \frac{f(x)-5}{x-2} = 3$ – since denominator $\to 0$, must have $\lim_{x\to 2} f(x) = 5$

(b) Similarly, $\lim_{x\to 2} f(x) = 5$ again.